

- Fig. 26. Distal part of the second right prehensile hand, from the outer side ;
 × 310.
27. Fourth left thoracic leg, from the outer side ; × 130. *b.*, branchia.
28. Distal part of the fourth left thoracic leg, from the outer side ; × 310.
vii., seventh joint.
29. Fifth right thoracic leg, from the outer side ; × 130.
30. Distal part of the fifth right thoracic leg, from the outer side ; × 295.
vii., seventh joint ; *c.*, claw.
31. Seventh left thoracic leg, from the outer side ; × 130.
32. The posterior segments of the abdomen with their appendages ; × 130.
pl., pleopod of the third pair.
33. First left pleopod, from the outer side ; × 310.

COPEPODA CALANOIDA, chiefly Abyssal, from the Faroe Channel
 and other parts of the North Atlantic. By Canon A. M.
 NORMAN, M.A., D.C.L., LL.D., F.R.S., F.L.S.

[Read 7th May, 1903.]

THE Copepoda to which the following paper has reference are from the northern parts of the North Atlantic Ocean. The larger number of them were procured by Sir John Murray in the 'Triton' Expedition of 1882, when they were taken in the Faroe Channel at various depths down to 600 fathoms. The deep-water forms were captured in a tow-net attached to, or near to, the dredge. It was not a closing net, and therefore the depths must be regarded only as approximate. A few specimens were from the 'Valorous' Expedition of 1875, and the remainder were the product of a very interesting tow-net gathering sent to me by Professor Haddon from 200 fathoms, 40 miles N.N.W. of Achill Head, Ireland.

At the time when they were found, most of the species in this list were new to science, but pressure of other work prevented my taking them in hand. I had named them partially, and when Professor G. O. Sars commenced his beautiful work, which is just finished, on the Calanoida, I sent some of these and other specimens to him for his use, believing at that time that he purposed to include the species of the Faroe Channel in his work, but he did not extend its range so far. He has now returned the specimens, and I have had the advantage of his determination of many of the more difficult forms, and of the Arctic species

described by himself from Nansen's voyage, and now found so much further south. Indeed, this paper has far greater interest than if it contained the description of new species.

The enormous range of these deep-water Copepoda is very remarkable. In the Faroe Channel we find species at considerable depths which Nansen met with near the surface at the point nearest to the North Pole from which any animals are known to us; and these are associated with other forms which are known to occur, some in the Mediterranean, some in the Gulf of Guinea and South Atlantic, one in the Antarctic Ocean, and some from the very centre of the Pacific Ocean.

When we consider the matter, we cannot be so greatly surprised at this very wide geographical distribution of abyssal Calanoid Copepoda, since at the depth at which they live—sometimes a varying depth according to latitude—whether under the Tropics or under vast fields of Arctic ice, they are living under conditions where they pass their lives at the same temperature. The isothermal line they are able to find for themselves. Their very active life, almost always on the move, tends of course greatly to wide dispersion, and small as they are, they must of necessity be subject to transportation from one place to another by the action of oceanic currents. We are beginning to learn more and more how widely diffused large numbers of genera and species are which live in the oceanic depths; but in no group of animals has this fact been more clearly demonstrated than in these notes, which record species which, if few in number, are yet, for the most part, of such remarkable distribution.

COPEPODA.

CALANOIDA.

Amphaskandria, Giesbrecht.

Fam. CALANIDÆ.

Genus CALANUS, *Leach.*

CALANUS FINMARCHICUS (*Gunnerus*).

Faroe Channel and Davis Strait. This is a surface plankton species abundant in the Arctic seas, and taken by Nansen "up to and beyond 85° of latitude" (*G. O. Sars*).

CALANUS HYPERBOREUS, *Krøyer*=*C. magnus*, *Lubbock*.

This large Calanoid was taken in the Faroe Channel down to 600 fathoms, and also in Davis Strait.

Fam. EUCALANIDÆ.

Genus RHINCALANUS, *Dana*.

RHINCALANUS NASUTUS, *Giesbrecht*.

1892. *Rhincalanus nasutus*, Giesbrecht, Pelagische Copepoden (Fauna und Flora des Golfes von Neapel, xix.), p. 154, pl. 3. fig. 6, pl. 11. figs. 6, 14, pl. 12. figs. 9-12, 14-16, pl. 35. figs. 46, 47, 49; and Das Tierreich, Copepoda, 1898, p. 22.
1901. *Rhincalanus nasutus*, G. O. Sars, Account of the Crustacea of Norway, Copepoda Calanoidea, p. 15, pls. 6 & 7.

Faroe Channel, surface to 40 fathoms ('Triton'); and 40 miles N.N.W. of Achill Head, Ireland, 220 fathoms (*Haddon*).

Genus EUCALANUS, *Dana*.

EUCALANUS ATTENUATUS (*Dana*).

1853. *Calanus attenuatus*, Dana, U.S. Explor. Exped. vol. xiii. p. 1080, pl. 75. fig. 2.
1856. *Calanus mirabilis*, Lubbock, Tr. Ent. Soc. London, n. s. vol. iv. p. 10, pl. 5.
1863. *Calanella mediterranea*, Claus, Freileb. Copepoden, p. 176, pl. 28. figs. 6-11.
1892. *Calanus attenuatus*, Giesbrecht, *l. c.* p. 131, pl. 3. fig. 1, pl. 11. figs. 1, 11, 13, 16, 18, 24, 40, pl. 35. figs. 3, 6, 17, 25, 34, 37, and 1898, *l. c.* p. 20.

Faroe Channel, 'Triton,' and 40 miles off Achill Head, 200 fathoms (*Haddon*).

Fam. PSEUDOCALANIDÆ, *G. O. Sars*.

Genus PSEUDOCALANUS, *Boeck*.

PSEUDOCALANUS ELONGATUS, *Boeck*.

Faroe Channel.

Fam. ÆTIDIIDÆ, *G. O. Sars.*Genus ÆTIDIUS, *G. S. Brady.*ÆTIDIUS ARMATUS (*Boeck*).

1872. *Pseudocalanus armatus*, Boeck, Nye Slægter or Arter af Saltvands-copepoder, Christ. Vid.-Selsk. Forhand. p. 38.

1901. *Ætidius armatus*, G. O. Sars, Crustacea Norway, p. 25, pls. 13, 14. Faroe Channel ('Triton').

Genus GAIDIUS, *Giesbrecht.*GAIDIUS TENUISPINUS, *G. O. Sars.*

1900. *Chiridius tenuispinus*, G. O. Sars, Norwegian North Polar Exped., Crustacea, p. 67, pl. 18; and 1901, *l. c.* p. 30, pl. 18, ♀; and *Gaidius tenuispinus*, 1903, *l. c.* p. 162, Supplement, pl. 6. fig. 1, ♂.

The Faroe Channel, 600 fathoms ('Triton'). The types were taken by Nansen in the 'Fram' at six stations in the Polar Sea, the most northern of which was near 85° N.

GAIDIUS BREVISPINUS, *G. O. Sars.*

1900. *Chiridius brevispinus*, G. O. Sars, North Polar Exped. p. 68, pl. 19.

1903. *Gaidius brevispinus* G. O. Sars, Account Crustacea Norway, vol. iv. Copepoda Calanoida, Supplement, p. 162, pl. 6. fig. 1.

With the last in 600 fathoms in the Faroe Channel ('Triton'). The type specimens were taken by Nansen in his Polar Expedition, and were found at the extreme north, 85° 13' N.; and a single specimen was taken by the 'Michael Sars' in 1900, between Jan Mayen and Finmark, "the depth being recorded to be from 500 and 1000 metres."

Genus GAETANUS, *Giesbrecht.*GAETANUS MILES, *Giesbrecht.*

1892. *Gaetanus miles*, Giesbrecht, Pelagische Copepoden, p. 219, pl. 14. figs. 21, 24, 25, 27, 30, pl. 36. figs. 1, 3; and 1898, p. 32.

Faroe Channel down to 600 fathoms. It has not previously been recorded north of 35°, but occurs both in the Atlantic and Pacific Oceans.

GAETANUS ARMIGER, *Giesbrecht*.

1892. *Gaetanus armiger*, Giesbrecht, Pelagische Copepoden, p. 219, pl. 14. figs. 19, 20, 22, 23, 26, 28, 29, pl. 36. figs. 2, 4, 5; and 1898, *l. c.* p. 33.

1893. *Ætidius armiger*, T. Scott, Trans. Linn. Soc. ser. 2, vol. vi. (1893) p. 71, pl. 8. figs. 16-27.

Faroe Channel, in 600 fathoms; not previously known north of the Gulf of Guinea.

Genus EUCHIRELLA, *Giesbrecht*.EUCHIRELLA ROSTRATA (*Claus*).

1866. *Undina rostrata*, Claus, Copepoden-Fauna von Nizza, Schrift. Gesells. gesamm. Naturwiss. Marburg, p. 11, pl. i. fig. 2.

1892. *Euchirella rostrata*, Giesbrecht, *l. c.* p. 232, pl. 2. fig. 11, pl. 15. figs. 6, 27, 28, pl. 36. figs. 16, 17, 23; and 1898, *l. c.* p. 36.

Faroe Channel, tow-net at 150 fathoms. Previously only known in the Mediterranean.

Genus EUCHÆTA, *Philippi*.EUCHÆTA NORVEGICA, *Boeck*.

1872. *Euchæta norvegica*, Boeck, Nye Slægter or Arter af Saltvands-copepoder, Christ. Vid.-Selsk. Förh. p. 40.

1902. *Euchæta norvegica*, G. O. Sars, Crustacea Norway, p. 38, pls. 34, 35, 36.

Lat. 50° 1' N., long. 12° 26' W., 'Porcupine' 1869: Faroe Channel down to 500 fathoms, 'Triton' 1882. Abundant also in Loch Eteve and Loch Fyne, West Scotland (*Sir J. Murray*). Nansen took it as far north as 84° 15'.

Fam. SCOLECITRICHIDÆ.

Genus SCOLECITHRIX, *G. S. Brady*.SCOLECITHRIX SECURIFRONS, *T. Scott*.

1893. *Scolecithrix securifrons*, T. Scott, Trans. Linn. Soc. ser. 2, vol. vi. (1893) p. 47, pl. 4. figs. 40-56, pl. 5. fig. 1.

1898. *Scolecithrix securifrons*, Giesbrecht, *l. c.* p. 40.

Faroe Channel down to 600 fathoms; and 40 miles N.N.W. of Achill Head, Ireland, 200 fathoms (*Haddon*). Previously known from the Gulf of Guinea and Bay of Biscay.

Heterarthrandria, Giesbrecht.

Fam. CENTROPAGIDÆ.

Genus CENTROPAGES, Kröyer.

CENTROPAGES TYPICUS, Kröyer.

Centropages typicus auctorum and *Ichthyophorba denticornis*, Claus.
Faroe Channel ('Triton').

Fam. TEMORIDÆ.

Genus TEMORA, Baird.

TEMORA LONGICORNIS (*Müller*).

Synonyms are *Temora finmarchica*, Baird, *Diaptonus longicaudatus*, Lubbock, and *Halitemora longicornis*, Giesbrecht.

Faroe Channel, surface tow-net.

Genus PHYLLOPUS, G. S. Brady.

PHYLLOPUS BIDENTATUS, G. S. Brady.

1882. *Phyllopus bidentatus*, G. S. Brady, Report 'Challenger' Copepoda, p. 78, pl. 5. figs. 7-16.

1892. *Phyllopus bidentatus*, Giesbrecht, Pelagische Copepoden, p. 419, pl. 18. figs. 25-33, pl. 38. fig. 35; and 1898, p. 124.

The occurrence of an example of this species in 600 fathoms in the Faroe Channel is certainly most interesting. The specimen agrees in minutest details with the figures of Brady and Giesbrecht in mouth-organs, in the 1st and following feet, (Giesbrecht (figs. 30 and 31); and above all in the characteristic and remarkable fifth foot of female (Brady, fig. 12; Giesbrecht, fig. 25). The single type was taken by the 'Challenger' in 2650 fathoms in the South Atlantic (lat. 36° 44' S., long. 46° 16' W.), while that figured by Giesbrecht was from 1800 metres in the tropical Pacific (lat. 3° S., long. 99° W.); and now it turns up in the Faroe Channel. It would be difficult to find a case which demonstrated more completely the vast range over which those animals may be distributed which find an equalized temperature in the depths of the ocean. The free-swimming life of the Calanoida of course conduces to their wide distribution, and that they have very wide distribution is also proved by the many other instances of hitherto supposed southern forms

which are in these brief notes now proved to reach those out-lying waters of the Arctic Ocean which fill the cold depths of the Faroe Channel.

Another very interesting case of distribution is that of *Amallopheora magna*, T. Scott. This was described by Prof. G. O. Sars in his account of the Crustacea obtained by Nansen in his Arctic voyage, under the name *Scaphocalanus acrocephalus*; and he wrote of it as "one of the most characteristic Calanoids of the Polar Sea," and "as one of the commonest forms collected both at the surface and down to 300 metres"; it, moreover, was among the species from the most northern gathering (lat. 85° 13' N., long. 79° E.). This species Sars has now found to be a synonym of *Amallopheora magna*, T. Scott, the types of which were collected in the tropical Atlantic (Gulf of Guinea) in only 20 fathoms (!), and is recorded by Giesbrecht under the name *Scolecithrix cristata* from the North, but not arctic, Pacific Ocean, lat. 35° N., long. 125° W.

Fam. METRIDIIDÆ.

Genus METRIDIA, Boeck.

METRIDIA LONGA (Lubbock).

1854. *Calanus longus*, Lubbock, 'Some Arctic Species of Calanidæ,' Ann. & Mag. Nat. Hist. ser. 2, vol. xiv. (1854) p. 127, pl. 5. fig. 10.
 1864. *Metridia armata*, Boeck, Oversigt Norges Copepoder, Christ. Vid.-Selsk. Forhand. 1864, p. 238.
 1892. *Metridia longa*, Giesbrecht, Pelagische Copepoden, p. 339, pl. 33. figs. 9, 13, 20, 23, 27, 34, 38; and 1898, p. 106.
 1902. *Metridia longa*, G. O. Sars, Crustacea Norway, p. 112, pls. 75 & 76.
 Baffin's Bay and Faroe Channel.

METRIDIA LUCENS, Boeck.

1864. *Metridia lucens*, Boeck, *l. c.* p. 238.
 1878. *Metridia armata*, G. S. Brady, Brit. Copep. vol. i. p. 42, pl. 2. figs. 1-12, pl. 56. figs. 19, 20.
 1892. *Metridia hibernica*, Giesbrecht, *l. c.* p. 340, pl. 33. figs. 2, 12, 16, 22, 28, 36, 39.
 1898. *Metridia lucens*, Giesbrecht, *l. c.* p. 106.
 1902. *Metridia lucens*, G. O. Sars, *l. c.* p. 113, pl. 77.

Faroe Channel, and 40 miles N.N.W. of Achill Island, Ireland, 200 fathoms.

METRIDIA NORMANI, *Giesbrecht*.

1892. *Metridia Normani*, Giesbrecht, Pelagische Copepoden, p. 340, pl. 33. figs. 1, 6, 24, 25, 30; and 1898, *l. c.* p. 107.

The types of this species were found by Herr Giesbrecht among some *Metridia longa* which I sent him from the Faroe Channel, and Prof. Sars has now detected a single specimen in the gathering made by Prof. Haddon in 200 fathoms off Achill Island, Ireland.

METRIDIA PRINCEPS, *Giesbrecht*.

1892. *Metridia princeps*, Giesbrecht, *l. c.* p. 340, pl. 33. figs. 3, 18, 35, 40; and 1898, *l. c.* p. 107.

Lat. 62° 6' N., long. 55° 56' W., 'Valorous' 1875.

Genus PLEUROMAMMA, *Giesbrecht*.PLEUROMAMMA ROBUSTA (*Dahl*).

1893. *Pleuromma robusta*, Dahl, Zoolog. Anzeiger, no. 415.

1898. *Pleuromamma robusta*, Giesbrecht, *l. c.* p. 110.

1902. *Pleuromamma robusta*, G. O. Sars, Crustacea Norway, p. 115, pls. 78, 79.

Faroe Channel, tow-net down to 600 fathoms; and 40 miles N.N.W. of Achill Island, Ireland, towing-net at 200 fathoms.

Fam. HETERORHABDIDÆ.

Genus HETERORHABDUS, *Giesbrecht*.HETERORHABDUS NORVEGICUS (*Boeck*).

1872. *Heterochaeta norvegica*, Boeck, Christ. Vid.-Selsk. Forhand. 1872, p. 40.

1898. *Heterorhabdus norvegicus*, Giesbrecht, *l. c.* p. 115.

1902. *Heterorhabdus norvegicus*, G. O. Sars, *l. c.* p. 118, pls. 80., 81.

Forty miles off Achill Head, Ireland, 220 fathoms.

Fam. PONTELLIDÆ.

Genus ANOMALOCERA, *Templeton*.ANOMALOCERA PATERSONI, *Templeton*.

Faroe Channel.

Fam. ACARTIIDÆ.

Genus ACARTIA, *Dana*.ACARTIA CLAUSI, *Giesbrecht*.

1892. *Acartia Clausi*, Giesbrecht, *l. c.* p. 507, pl. 30. figs. 2, 4, 13-15, 17, 28, 36, 37, pl. 42. fig. 32, pl. 43. figs. 3, 5, 14; and 1898, *l. c.* p. 152.

Faroe Channel.

Isokerandria, Giesbrecht.

Fam. ONCÆIDÆ.

Genus ONCÆA, *Philippi.*ONCÆA CONIFERA, *Giesbrecht.*

1892. *Oncæa conifera*, Giesbrecht, Pelagische Copepoden, p. 591, pl. 47. figs. 5, 15, 21, 23, 28, 31-38, 55, 56.
1902. *Oncæaconifera*, Giesbrecht, Expedition Antarctique Belge 'Belgica,' 1897-1899, Zoologie, Copepoden, p. 41, pl. 13. figs. 7-11.

Here is another species of very wide distribution. Described from Mediterranean specimens, it was found by Sir J. Murray in the 'Triton' Expedition of 1882, in the Faroe Channel down to the depth of 500 fathoms, and now Giesbrecht announces it as having been collected in the Antarctic Ocean by the Belgian Antarctic Expedition of 1897-1899.

? ONCÆA MEDIA, *Giesbrecht.*

1892. *Oncæa media*, Giesbrecht, *l. c.* p. 591, pl. 47. figs. 1, 11, 29-33, 40.

An *Oncæa* taken by the 'Triton' in the Faroe Channel, and which I had sent to Prof. Sars marked "*Oncæa media* ?," was sent back marked in his own writing "? *Oncæa media*," so that it must be regarded as a doubtful inhabitant of the locality given.

Genus CONCÆA, *Giesbrecht*, 1891.CONCÆA RAPAX, *Giesbrecht.*

1892. *Concæa rapax*, Giesbrecht, *l. c.* p. 605, pl. 48. figs. 50-59.
1894. *Oncæa gracilis*, T. Scott, Entomostraca Gulf of Guinea, Trans. Linn. Soc. ser. 2, vol. vi. (1894) p. 116, pl. 13. figs. 4-12.

A single specimen in the Faroe Channel at a depth of 600 fathoms. Giesbrecht's type specimens were taken in the tropical part of the Pacific Ocean down to 4000 metres. Next it was taken in the tropical Atlantic (Gulf of Guinea), and now it turns up in the cold area of the Faroe Channel. Had it been found at great depths in the Gulf of Guinea, we might have supposed that though living over so large a range, it yet inhabited water of nearly equal temperature; but Mr. Scott tells us that the specimens which came under his observation were taken at various depths, ranging from the surface to 360 fathoms. It is possible that these may be closely allied species confused, but the posterior antennæ and posterior foot-jaws of the female are very remarkable.